Title of Paper: Deep Space Network Ground Communication Services

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Deep Space Network Ground Communication Services

The National Aeronautics and Space Administration (NASA) Deep Space Network - or DSN - is an international network of antennas that supports interplanetary spacecraft missions and radio and radar astronomy observations for the exploration of the solar system and the universe. The network also supports selected Earth-orbiting missions.

The DSN currently consists of three deep-space communications facilities placed approximately 120 degrees apart around the world: at Goldstone, in California's Mojave Desert; near Madrid, Spain; and near Canberra, Australia. This strategic placement permits constant observation of spacecraft as the Earth rotates, and helps to make the DSN the largest and most sensitive scientific telecommunications system in the world.

Fundamentally, the DSN ground network architecture is a star network, and the hub is at the Jet Propulsion Laboratory (JPL) in Pasadena, California. The ground network supports real-time data, voice, and video communications among antenna stations, an automated multi-mission operations systems facility at JPL (AMMOS), and project operations centers (POCs).

This presentation will describe the global ground network, describe current and emerging requirements, and indicate where new technology is being applied. Major drivers for a new approach are a desire to keep infrastructure costs as low as possible, desire to use the public Internet for communications, wide-scale development and availability of commercial Internet-standard products, need for increased security, and increasing needs for fault tolerance.

The network is distinctly layered, and improvements are being made at each layer. We will describe technologies that are being applied at the physical layer, data link layer, and network layer. We will also include an overview of common operational supporting services that generally reside at the application layer, which place significant demands on the underlying ground network architecture.

Lastly we will describe our goals and vision for monitor and control of the ground network.

The physical layer includes wide area network (WAN) circuits, local area networks (LANs), and backbone campus-like networks at Goldstone, CA, and within AMMOS. These networks are being upgraded to handle increasing traffic levels and simplify their manageability.

The data-link layer includes new virtual network capabilities at each station that will allow antenna monitor and control traffic and spacecraft product delivery traffic to share a common backbone.

The network layer includes upgraded router capabilities for dynamic bandwidth allocation and traffic shaping. We will describe transition plans for voice and video onto IP backbone networks, and technologies to limit certain functions from dominating limited overseas circuit bandwidth.

Infrastructure services generally support operations, program administration, and multi-mission processing. These services include: (1) the distributed computing environment (DCE) and distributed file system, (2) a reliable network service which provides real-time stream data delivery to our customers in AMMOS and the POCs with no errors and no loss, and (3) operational messaging and worldwide web intranet services. These services require the network to dynamically allocate bandwidth and maintain a very high availability.